

CLAIMS

1. An abnormality detecting device of a fuel cell system, comprising:
 - a hydrogen off-gas circulation passage for making hydrogen off-gas discharged from a fuel cell flow back to an anode of the fuel cell;
 - a discharge passage for discharging part of the hydrogen off-gas, which is circulated through the hydrogen off-gas circulation passage, from the hydrogen off-gas circulation passage;
 - a hydrogen discharge valve provided in the discharge passage; and
 - abnormality determining means for determining whether an abnormality has occurred in opening/closing of the hydrogen discharge valve, characterized by further comprising:
 - gas state quantity detecting means for detecting a gas state quantity of the hydrogen off-gas, the gas state quantity detecting means being provided in the discharge passage at a position downstream from the hydrogen discharge valve, wherein the abnormality determining means determines whether an abnormality has occurred in opening/closing of the hydrogen discharge valve based on the gas state quantity of the hydrogen off-gas.
2. The abnormality detecting device of a fuel cell system according to claim 1, further comprising:
 - a mixing chamber for mixing the hydrogen off-gas discharged from the discharge passage with external gas, wherein the gas state quantity detecting means detects the gas state quantity of the hydrogen off-gas which is mixed with the external gas in the mixing chamber.
3. The abnormality detecting device of a fuel cell system according to claim 2, wherein the external gas is part of oxidizing gas to be supplied to a cathode of the fuel cell.
4. The abnormality detecting device of a fuel cell system according to any one of claim 1 to claim 3, wherein the hydrogen discharge valve is an electromagnetic valve, and the abnormality determining means determines whether an abnormality has occurred in opening/closing of the hydrogen discharge valve based on the gas state quantity detected by the gas state quantity detecting means so as to deal with a change in an

input of an opening/closing control signal to the electromagnetic valve.

5. The abnormality detecting device of a fuel cell system according to claim 4, wherein the abnormality determining means determines whether an abnormality has occurred in opening/closing of the electromagnetic valve based on a change with time in the gas state quantity detected by the gas state quantity detecting means so as to deal with the change in the input of the opening/closing control signal to the electromagnetic valve.
6. The abnormality detecting device of a fuel cell system according to any one of claim 1 to claim 5, wherein the gas state quantity is a physical quantity related to one of a hydrogen concentration, a flow speed, a pressure, a proportion of each ingredient, a temperature and a dielectric constant of the hydrogen off-gas.
7. The abnormality detecting device of a fuel cell system according to any one of claim 1 to claim 6, further comprising:
gas state quantity detecting means for detecting the gas state quantity of the hydrogen off-gas, the gas state quantity detecting means being provided in the discharge passage at a position upstream from the hydrogen discharge valve, wherein the abnormality determining means detects an abnormality in opening/closing of the hydrogen discharge valve based on the gas state quantity detected by the gas state quantity detecting means provided on each of an upstream side and a downstream side of the hydrogen discharge valve.
8. The abnormality detecting device of a fuel cell system according to any one of claim 1 to claim 7, further comprising:
gas-liquid separating means for separating the hydrogen off-gas into gas and liquid, wherein the gas state quantity detecting means detects the gas state quantity of the hydrogen off-gas which has been separated into gas and liquid by the gas-liquid separating means.
9. The abnormality detecting device of a fuel cell system according to any one of claim 6 to claim 8, further comprising:
a pressure sensor which is provided in the discharge passage at a position

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downstream from the hydrogen discharge valve, and which detects a pressure of the hydrogen off-gas.

10. The abnormality detecting device of a fuel cell system according to any one of claim 6 to claim 8, further comprising:
 - a temperature sensor which is provided in the discharge passage at a position downstream from the hydrogen discharge valve, and which detects a temperature of the hydrogen off-gas.
11. The abnormality detecting device of a fuel cell system according to any one of claim 6 to claim 8, further comprising:
 - paired electrodes which are provided in the mixing chamber and which are opposed to each other in order to detect a dielectric constant of the hydrogen off-gas.
12. The abnormality detecting device of a fuel cell system according to any one of claim 6 to claim 8, further comprising:
 - a heat wire resistance which is provided in the mixing chamber and which detects a heat conductivity of the hydrogen off-gas.
13. The abnormality detecting device of a fuel cell system according to any one of claim 1 to claim 12, further comprising:
 - means for dealing with a failure when the abnormality determining means detects an abnormality in opening/closing of the hydrogen discharge valve.